

# **BOSTON HARBOR NAVIGATION IMPROVEMENT STUDY REPORT SUMMARY FOR CIVIL WORKS REVIEW BOARD**

## **STUDY INFORMATION**

The U.S. Army Corps of Engineers (Corps) in partnership with the Massachusetts Port Authority, and in cooperation with other Federal and State agencies, has prepared this Feasibility Report (FR) and Supplemental Environmental Impact Statement (SEIS) of proposed channel and associated navigation feature improvements to the Port of Boston.

**Study Authority:** The U.S. Army Corps of Engineers has been authorized to conduct a study of navigation improvements at Boston Harbor in response to Senate Subcommittee on Public Works Resolution dated September 11, 1969, which reads:

“Resolved by the Committee on Public Works of the United States Senate, (September 11, 1969), that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act of June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on Boston Harbor, Massachusetts, published as House Document Numbered 733, Seventy-ninth Congress, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to modifying the project dimensions of the Main Ship Channel from deep water in Broad Sound to the upstream limit of the Federal project in the Mystic River.”

The 905(b) Reconnaissance Report was initiated in December 1999 using funds provided in the Energy and Water Development Appropriations Act for Fiscal Year 2000 (language below), and approved by the North Atlantic Division and HQUSACE in August 2000. The FCSA was executed on 27 June 2002.

“*Boston Harbor, Massachusetts.*—The Committee has provided funding for a reconnaissance study to evaluate the deepening of the Main Ship, Reserved and Entrance Channels to Boston Harbor, Massachusetts.”

**Study Sponsor:** The Massachusetts Port Authority (Massport) is the non-Federal Sponsor for the feasibility study and has indicated its willingness to sponsor project design and implementation. Massport is a public legislatively chartered independent State authority with its own budgetary authority.

**Study Purpose and Scope:** The purpose of this study was to determine the feasibility of navigation improvements at the Port of Boston, consistent with the goals of the study sponsor, Massport, and in response to direction from Congress in the authorizing resolution. The principal focus is to investigate plans to provide deeper access to Massport’s Conley Container Terminal on the Reserved Channel in South Boston at a depth at least equal to the 45 feet now available at that facility’s berths. Additional minor port improvements in the Mystic and Chelsea Rivers and in the Main Ship Channel above the Reserved Channel were also studied and have been recommended.

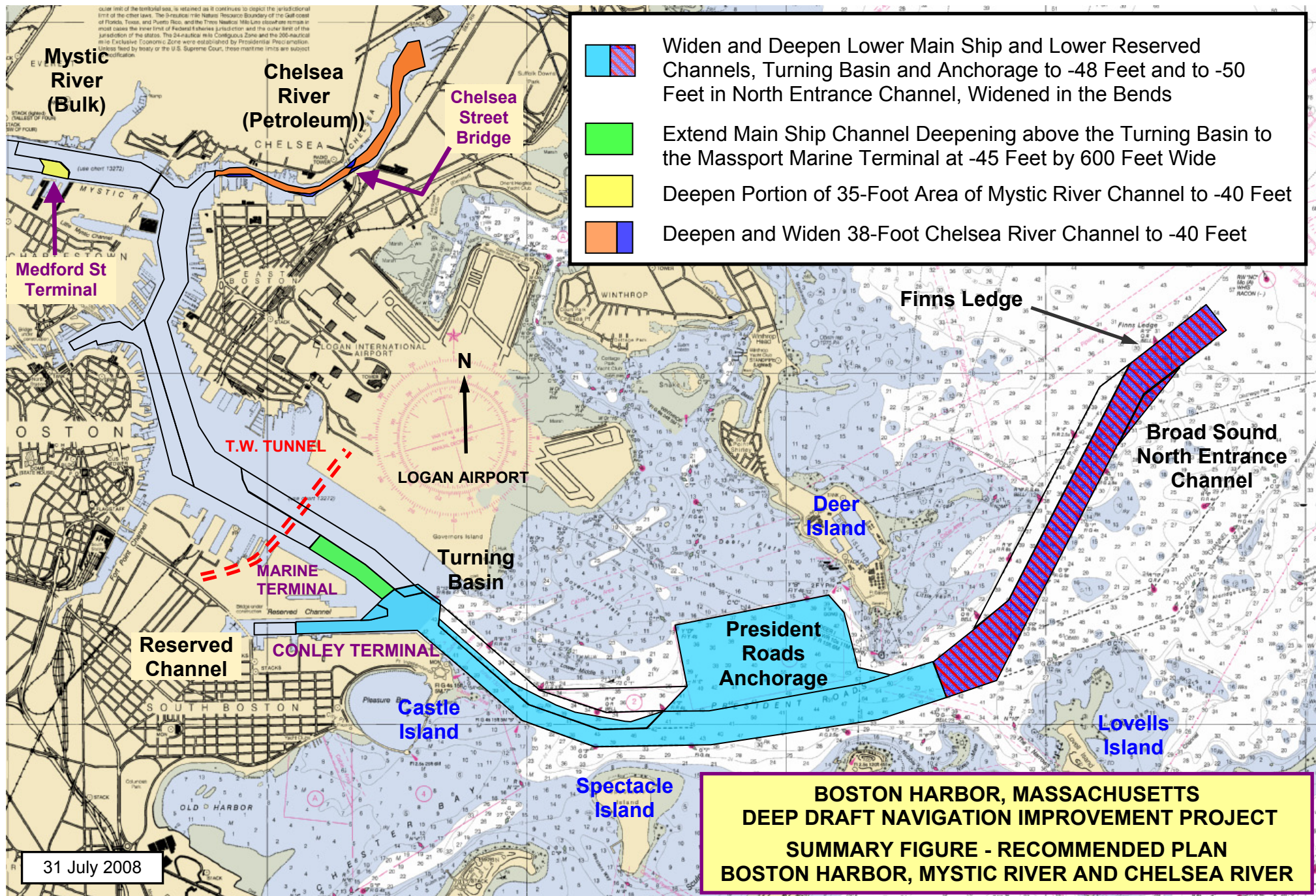
**Project Location and Congressional Districts:** Boston Harbor is located in eastern Massachusetts on the western shore of Massachusetts Bay. Boston is the New England region's largest port. The Port and project area are partially located in the Massachusetts 7<sup>th</sup> (E. Markey), 8<sup>th</sup> (M. Capuano), 9<sup>th</sup> (S. Lynch), and 10<sup>th</sup> (W. Delahunt) Congressional Districts. One of the sites under consideration for beneficial use of dredged materials lies offshore of the 6<sup>th</sup> District.

**Prior Reports and Existing Water Projects:** Boston Harbor and its improved tributaries have been the subject of numerous reports by the Corps of Engineers since 1825. The project includes stone works of preservation on the islands and headlands, and dredged channels, anchorage, and turning areas. The basis for the existing project, as modified through the Water Resources Development Act of 1990, can be found in House Document number 733, 79<sup>th</sup> Congress, 2<sup>nd</sup> Session, and in House Document number 150, 105<sup>th</sup> Congress, 1<sup>st</sup> Session, 21 October 1997. The main deep water harbor is comprised of the waterways of the Main Ship Channel, Reserved Channel, Mystic River and Chelsea River. These channels provide access at a depth of 40 feet at mean lower low water (MLLW) to the Port's principal terminals, except for the Chelsea River which has an authorized depth of 38 feet MLLW. Deep water access to the harbor is provided by three entrance channels; the Broad Sound North Channel at 40 feet, the Broad Sound South Channel at 30 feet, and the Narrows Channel at 27 feet.

**Federal Interest:** The recommended plan meets the principal objective of the study authority; navigation improvement. Federal interest is clearly demonstrated by the positive benefit-to-cost (BCR) ratio for each of the four separate improvement segments of the overall study. BCR's are: Main Channel Improvement (1.64 to 1), Main Ship Channel Extension to Marine Terminal (2.13 to 1), Mystic River Channel Deepening (1.59 to 1), Chelsea River Channel Deepening (2.96 to 1), Combined Total for All Recommended Improvements (1.74 to 1). The total combined project cost is \$307,700,000. Channel improvement depths for each element were based optimized based on maximization of net economic benefits. All pertinent cost and benefit information can be found in Tables 1 and 2. The City of Boston, Massachusetts is the hub of the nation's eleventh largest metropolitan area, with a population of nearly 4.5 million. The Corps of Engineers has a long history of supporting waterborne commerce at Boston Harbor by contributing the port's water resources infrastructure in partnership with the States and local agencies. This has provided the port with an extensive system of deep draft channels and other navigation features to serve the six-state region's 14.3 million residents with efficient transportation of domestic and international cargo. The Port's terminals handled about 22 million tons of liquid and dry bulk, containerized, and general cargo in 2006 through more than twenty public and private terminals. Containerized cargo is handled at Massport's Conley Terminal on the Reserved Channel in South Boston. In 2006 this containerized cargo had a value of more than \$5.5 billion, more than 60 percent of the value of all cargo ship through the port. Boston is New England's largest general cargo port and the Atlantic Coast's 10<sup>th</sup> largest port.

As with all transportation infrastructure, improvements in capacity are periodically required to continue meeting the Nation's and region's needs. With the recent and continued growth in waterborne commerce, the number of services and sizes of vessels engaged in the transport of goods, particularly containerized cargo, has grown also. A large percentage of New England containerized cargo is landed and loaded at terminals in the Port of New York and New Jersey





(PONYNJ), and carried overland by truck through New England. Landing and loading a larger portion of that cargo at Boston would save time and cost, but would require deepening Boston's channels to permit those larger and more heavily laden ships to call on the port.

Similarly, this study has also examined bulk cargo shipping at Boston Harbor, including liquid petroleum fuels and dry bulk cargo, to determine whether navigation improvements could provide transportation cost savings for those classes of goods.

## STUDY OBJECTIVES

The goal of the report was to document the formulation and evaluation process followed for the Boston Harbor Deep Draft Navigation Improvement Study, to identify cost effective, implementable navigation improvement alternatives, and to recommend a preferred alternative. The analysis and recommendation are consistent with the direction and language calling for the study, and conform to Federal statutes, regulations and Corps guidance governing the development of water resource projects and reports. This study also included preparation of a Supplemental Environmental Impact Statement (SEIS).

**Problems and Opportunities:** This study focused on improving safe navigation access to Boston Harbor's deep draft cargo terminals. Growth in waterborne shipping of containers and bulk commodities is constrained by lack of adequate channel dimensions, particularly depth, to meet the needs of the Port Authority, its customers, and other terminal operators. To meet the demand of increased container volumes, shippers are moving to larger vessels, and ports that wish to remain in the shipper's rotation must increase their access and berth depths to receive those vessels. For bulk commodities, transport in larger vessels results in unit-cost savings for the cargoes carried. Alternatives to deeper-draft waterborne transport, such as rail and truck, or smaller draft vessel carriage, are all more costly, leading to transportation cost-savings for port improvements.

**Planning Objectives:** The objective of the Boston Harbor Navigation Improvement Study is to develop an optimal plan for effectively and efficiently accommodating existing and prospective deep-draft vessel traffic in the Port of Boston. The optimal plan for Federal participation must be consistent with the Corps National Economic Development (NED) perspective as set forth in the Principles and Guidelines and must also account for the Regional Economic Development (RED) perspective. Plans must also account for Other Social Effects (OSE), be acceptable from the perspective of Environmental Quality (EQ), and be in concert with the Chief of Engineers' Environmental Operating Principles. Plans developed for analysis must be formulated to be complete, effective, efficient and acceptable, and to reasonably maximize net benefits over the 50-year period of analysis beginning with completion of construction projected for 2014. The following are the principal planning objectives for this study:

- Contribute to National Economic Development by minimizing the cost of transporting existing cargo volumes and anticipated future increases in cargo volumes to and from New England in an environmentally acceptable and sustainable manner. Means of reducing tidal delays, light-loading, lightering and increasing cargo capacity were examined for containerized, dry bulk and liquid bulk cargoes.

- Maximize the beneficial use of dredged material; particularly the large volume of rock that channel deepening would yield, for habitat creation and or other purposes during initial construction and future maintenance of the project.

**Planning Constraints:** Planning constraints are restrictions that limit the planning process and the available scope of solutions to the identified problems, or that limit consideration of opportunities. Planning constraints are either institutional (laws, policies and regulations governing Federal water resource project development), physical (sites available for port improvements), economic (limits on sponsor financing), environmental (habitat, endangered species) or sociological (cultural resources, strong local opposition). The following constraints were considered:

- Highway and subway tunnels crossing beneath the harbor limit the deepening of the port beyond it existing 40-foot channels to areas of the waterfront seaward of the lower-most tunnel (I-90 – the Ted Williams Tunnel).
- There is only one container terminal at Boston - Massport's Conley Terminal on the Reserved Channel. No other land is available around the harbor sufficient in size for development of another terminal, especially down-harbor of the tunnels. This will constrain the scope of alternative terminal sites that can be considered.
- Improvement of the Chelsea River Channel beyond the 38 feet now provided, is contingent on replacement of the Chelsea Street Bridge by the State and City. Bridge replacement by the State, City and USCG is scheduled for 2008-2010.
- The presence of lobsters, anadromous fish, and other fisheries in the harbor will require development of a construction sequencing plan during the Design Phase, before the final regulatory reviews for the project, to enable construction to proceed without interruption while avoiding or minimizing impacts to different species found in the various areas of the harbor at environmentally critical times of year.
- Develop plans consistent with the US Coast Guard's stated needs for port security.
- The presence of the endangered right whale and other cetaceans at the disposal site will require use of whale observers to avoid impacts to these species.
- Massport's without-project upgrades to Conley Terminal efficiency scheduled for completion in 2010 are needed to handle significant increases in throughput.

## ALTERNATIVES

**Plan Formulation Rationale:** Plans to address the problems and opportunities for navigation at Boston Harbor were developed consistent with the Planning Objectives and Constraints outlined above. The locations of existing channels and terminals, and absence of sites available for development of new terminals, limited the range of practicable alternatives. For each project segment various channel dimensions were examined relative to design vessel needs and projected cargo volumes. Measures to improve navigation and capacity were identified, screened and further developed into detail plans. Plans were further evaluated and optimized to select a recommended plan of improvement for each project segment.

**Management Measures and Alternative Plans:** Structural and non-structural measures were examined to address the navigation problems and opportunities of the port. These included:



- Entrance channels – which of the harbor’s three entrance channels was most economic to provide a deeper depth than the current 40 feet in the North Entrance Channel.
- Regional ports – Investigation of alternatives to Boston Harbor for development of a regional container port to replace the Conley Terminal in terms of regional growth. These were examined and dismissed due to lack of infrastructure and excessive cost.
- Tidal Navigation – use of tidal assistance in combination with channel depth to maximize port access by larger ships. Tidal assistance taking advantage of Boston’s 9-foot average tidal range is currently practiced by larger carriers, with berths dredged deeper than the channels to facilitate this practice.
- Beneficial Use of Dredged Materials - Habitat creation using rock blasted from the channel was examined. Use of other dredged materials for remediation purposes in the Bay was also examined with US EPA. Further analysis of these opportunities will be required in the Design Phase.
- Rail and Barge Transportation and greater use of smaller containerships – alternatives to deeper-draft containership carriage of cargo to Boston were examined and dismissed to due increased cost over both trucking and larger containerships.
- Anchorage needs for port security and emergency purposes as opposed to typical vessel operations were incorporated in consultation from the USCG and harbor pilots.

**Final Array of Alternatives:** The final array of alternatives, shown in the Summary Figure, was limited to the deepening of the existing channels serving existing terminals. Four improvement plans were developed.

- Main Channels Improvements for Conley Terminal Access – Containers: Plans for improving access to the Conley Terminal for containerships included deepening of the Broad Sound North Entrance Channel, the Main Ship Channel through President Roads up to the Reserved Channel, the lower Reserved Channel at the Conley Terminal, the Reserved Channel Turning Area and the President Roads Anchorage. Incremental Depths of from -42 to -50 feet at mean lower low water (MLLW) were examined. In all plans the entrance channel would be dredged two feet deeper than the interior channels to account for increased seas and vessel motion. Berths at the Conley Terminal, now 45 feet, would be deepened to at least 3 feet greater than the channel depth provided to facilitate continued use of tidal assistance by transiting vessels.
- Extend Main Ship Channel Deepening to Massport Marine Terminal – Dry Bulk: A plan for improving access to the Massport Marine Terminal (MMT) was developed for deeper draft dry bulk carriers, by extending the deepening of the Main Ship Channel above the Reserved Channel Turning Area to the Marine Terminal. Depths of from -42 to -45 feet were examined to deepen the existing 40-foot by 600-foot wide lane. The berth at the MMT would be deepened commensurate with that provided in the channel.
- Mystic River Channel Access to Medford Street Terminal – Dry Bulk: A plan for improving access to Massport’s Medford Street Terminal on the Mystic River for lesser draft dry bulk and break-bulk carriers was developed. Depths of from -37 to -40 feet were examined for smaller bulk operations than would be accommodated at the MMT. Massport has already cleared the site and deepened the berth to 40 feet, leaving a small area of the 35-foot Federal channel between the berth and the 40-foot channel.
- Chelsea River Channel Deepening – Liquid Petroleum: Plans for improving access to the Chelsea River primarily for its petroleum terminals were developed. This would deepen the existing 38-foot channel to either 39 or 40 feet. Any improvement would be

contingent on replacement of the Chelsea Street Bridge by the State, City and USCG, as the existing bridge precludes the use of larger vessels.

Improvements to the Mystic and Chelsea Rivers were limited to -40 feet MLLW due to the downstream tunnel restrictions.

**Comparison of Alternatives:** Screening analysis dismissed all alternatives other than channel modifications, with tidal assistance factored into the design and economic evaluations. Plans for each of the four project segments; main channels, marine terminal extension, Mystic River and Chelsea River, were examined at one-foot increments to optimize the improvements. The highest net annual benefits for each segment were as follows:

- Main Channels Improvement – Plan B – 48 Feet with 50 Feet in the entrance
- Marine Terminal Extension of Main Ship Channel – Plan D – 45 Feet
- Mystic River Channel at Medford Street Terminal – 40 Feet
- Chelsea River Channel – 40 Feet

Hydrodynamic and ship simulation studies were conducted for the Chelsea River in 1993, and for the Main Channels Improvements in 2005-2007 to examine the handling characteristics of the evaluated design vessels in each these waterways. Minor modifications were made to the proposed channel layouts in each of these segments as a result of these studies.

**Key Assumptions:** Recommendations on channel improvements and depth optimization are predicated on levels of commerce identified through investigation and forecasts of future commerce. The without-project (no action) alternative assumes:

- The Chelsea Street Bridge would be replaced on schedule before any channel improvements are completed (scheduled for 2010)
- Massport's efficiency upgrades to the Conley Terminal are completed before any channel improvements (scheduled for 2010)
- The Massport Marine Terminal begins operations before any channel improvements are made
- Users of the Medford Street Terminal on the Mystic River are identified before any channel improvements are made
- Growth in east coast container cargo volumes occur at least at the level predicted in the economic trade forecasts.

**Recommended Plan of Improvement:** The recommended plan of improvements, as shown in Figure ES-1, consists of improvements accessing four segments of the port. The recommended plan for each project segment maximizes net national economic development benefits and so is the NED Plan, while avoiding or minimizing significant adverse impacts. Rock would be drilled and blasted. Rock and all other material would be removed by a heavy toothed bucket dredge, placed in scows and towed to the Massachusetts Bay Disposal Site about 18 miles east of the harbor. Beneficial use opportunities identified during the study, including creation of hard bottom habitat in Broad Sound and Massachusetts Bay using the rock, or capping of the former Industrial Waste Site in Massachusetts Bay using the unconsolidated dredge materials, or use of rock by the State and others for shore protection projects, will be investigated further during project design and used if found feasible and approved through further review. The deepening is almost entirely confined to the very slow shoaling existing channel limits minimizing adverse impacts. Additional design phase

investigations will develop plans for blasting and construction sequencing to further avoid and minimize impacts.

Main Channels Improvement to Access the Conley Terminal – Access from the Bay to the port's sole container terminal would be improved (Plan B) as follows:

- The 40-foot deep lane of the Broad Sound North Entrance Channel would be deepened to 50 Feet MLLW from Massachusetts Bay to the harbor's Outer Confluence. The Channel would also be widened in the bend opposite Finns Ledge near its entrance to ease the turning of larger vessels.
- The 40-foot lane of the Main Ship Channel from the Outer Confluence, through President Roads and up to the Reserved Channel would be deepened to 48 feet MLLW. The 1200-foot width through the Roads would be retained, and the channel widened to 900 feet through the turns above the roads, and to 800 feet above the turns to the Reserved Channel, with further widening in bend apexes. The widening would be accomplished by incorporating areas of the current 35-foot lane into the deepened lane.
- The President Roads Anchorage would be deepened to 48 feet over its existing area, sufficient to accommodate two large vessels at anchor.
- The lower 40-foot reach of the Reserved Channel along the Conley Terminal would be deepened to 48 feet, and widened east of the former Army Base Pier in its transition to the Turning Area.
- The 40-foot Reserved Channel Turning Area would be expanded from its current 1200-foot diameter to 1500 feet, deepened to 48 feet MLLW, and widened 100 feet further northeast.

These improvements would require the removal of about 953,000 cubic yards (CY) of rock and about 11.1 million CY of ordinary dredged material (unconsolidated – largely Boston blue clay, glacial till, sand, and cobble).

Main Ship Channel Deepening Extension to Massport Marine Terminal – The 40-foot lane of the Main Ship Channel would be deepened to 45 feet MLLW above the Reserved Channel Turning Area for a distance of about 2600 feet, at the existing width of the 600 feet, to accommodate large dry bulk carriers, principally cement, to access the redeveloped Marine Terminal (Plan D). Massport and its redevelopment partners plan to complete work on the terminal in 2010. Benefits derive from use of larger vessels to transport bulk cargos including cement. This is the last deepwater terminal site seaward of the harbor tunnels. This improvement would yield about 246,300 CY of ordinary dredged material and 78,400 CY of rock.

Mystic River Channel Access to Medford Street Terminal – A 9-acre area of the 35-foot channel lane would be deepened to 40 feet MLLW to connect the existing 40-foot channel lane with the 40-foot berth at the Massport Marine Terminal (Plan E). Project benefits for this segment derive in general from dry-bulk cargo shipping efficiencies from use of larger vessels. This improvement would yield about 67,100 CY of ordinary dredged material. No rock removal is required for this channel. This recommendation is contingent on the identification of terminal users sufficient to support the economic justification before dredging.



Chelsea River Channel – The existing 38-foot channel and the turning basin at its upper end would be deepened to 40 feet MLLW (Plan F). The channel would be widened by 50 feet along the East Boston shore in two locations; just upstream of the McArdle Bridge near the river's mouth, and in the bend downstream of the Chelsea Street Bridge. The channel would be widened to 225 feet through the opening of the new Chelsea Street Bridge. This plan would yield about 342,600 CY of ordinary dredged material and 500 CY of rock. This recommendation is contingent on the replacement of the bridge before dredging.

**Systems/Watershed Context:** Improvements to the Port of Boston have been limited to deepening existing project features to serve existing terminals. There are no major rivers discharging into the harbor and all project features are in tidal waters. The two minor rivers discharging into the port area, the Charles and Mystic Rivers, are both controlled by dams at or a short distance above the existing improved deep-draft channels. Deepening the existing channels will have no negative impact on the watersheds of these rivers. From a coastal system perspective, the materials to be removed are mostly rock and clay. Little to none of the material would be suitable for beach nourishment. This study was fully coordinated throughout in a collaborative manner with the sponsor (Massport) and the Technical Working Group (TWG) which is comprised of Federal, state, and municipal agencies, local universities, and non-governmental organizations (NGO's) with an interest in Boston Harbor.

**Environmental Operating Principals (EOP):** The recommended plan fully supports each of the seven USACE Environmental Operating Principles. **1. Strive to Achieve Environmental Sustainability.** The recommended plan involves the use of the existing channels also capitalizes on the harbor's low sustainable maintenance dredging frequency of 16 to 40 years. **2. Recognize the Interdependence of Life and the Physical Environment.** The potential beneficial use opportunities identified in the study represent an opportunity for balance between port development and the environment. The removed rock could be used to create offshore habitat, or potentially by the State or others for shore protection purposes on area projects. **3. Seek Balance and Synergy among Human Development Activities and Natural Systems.** By focusing on improvements to existing project features for the benefit of existing terminals the project minimizes the impacts of construction and port operations. **4. Accept Responsibility and Accountability under the Law.** Implementation of the recommended plan will ensure that the project complies with all Federal and State laws and regulations most notably in the areas of economic justification, environmental impacts, and agency and external peer review. **5. Seek Ways and Means to Assess and Mitigate Cumulative Impacts to the Environment.** A portion of the dredged material has been suggested for use as cap material for the former EPA designated Industrial Waste Site (IWS) in Massachusetts Bay, which was used until the early 1970s for disposal of chemical, low level radiological and medical waste in barrels and concrete containers still visible on the ocean floor. **6. Listen to, Respect and Learn from the Perspectives of Individuals, and Groups Interested in Corps Activities.** This study was fully coordinated throughout in a collaborative manner with the sponsor (Massport) and the Technical Working Group (TWG) which is comprised of Federal, state, and municipal agencies, local universities, and local non-governmental organizations (NGO's) with an interest in Boston Harbor. **7. Build and Share an Integrated Scientific, Economic, and Social Knowledge Base.** The TWG had been established during review of the EIS for the 1990 authorized project and was continued through the development of the two major maintenance actions, the last of which is still underway. The TWG was used to solicit input on study scope, review of study findings, and

dissemination of study information, materials, and recommendations and has been in continuous operation with Corps efforts in Boston Harbor for 18 years.

The project was designed and the study conducted in accord with the requirements of the National Environmental Policy Act. A Supplemental Environmental Impact Statement (SEIS) was prepared for this project, furthering the evaluation finalized in June 1995 for the 1990 authorized project and the SEIS prepared for the Inner Harbor maintenance dredging project finalized in May 2006.

**Independent Technical Review and Peer Review:** Agency Technical Review for this study has been managed by the Deep Draft Navigation Planning Center of Expertise at the Corps South Atlantic Division, Mobile District (SAM). SAM has tasked the New York District with technical review of the study documents. The Corps Center of Expertise for Cost Estimating at the Walla Walla District (NWW) has been tasked with technical review of the project cost estimates. NAN forwarded its completed ITR sign-off to SAM on 18 July 2008. NWW forwarded its completed Cost ITR sign-off on 30 June 2008.

SAM has also managed an Independent External Peer Review of the study documents by experts outside of the Corps of Engineers. The IEPR report was completed and provided to the New England District on 3 June 2008. The results of these reviews have been addressed and incorporated into the final project documents and recommendation.

## **EXPECTED PROJECT PERFORMANCE**

**Project Costs:** Project costs are shown in Table 1. Project costs were developed at January 2008 price levels and include costs for improvements to General Navigation Features (GNF - the channels, anchorage, and turning basins), costs for Local Service Facilities (LSF - berth deepening at terminals), costs for relocating aids to navigation (ATON - US Coast Guard), and real estate requirements during construction. GNF costs consist of drilling and blasting of rock, dredging and disposal of dredged material and rock, and costs for equipment mobilization, planning, engineering and design, construction management and inspection, and environmental monitoring. No mitigation requirements have been identified, and the design phase includes development of plans for construction sequencing, blasting practices, examination of alternative air quality compliance measures, optional beneficial uses for rock, post-maintenance resource baseline characterization, and biological recovery monitoring.

**Equivalent Annual Costs and Benefits:** To determine whether Federal interest in the proposed improvements is warranted, the project has been evaluated for its environmental impacts, social effects, and economic justification. Project benefits were developed based on January 2008 price levels using a project base year of 2014 for completion of construction. Economic justification is expressed in terms of Benefit-Cost analysis. Project costs are discounted to present value and amortized over the project life. They are then compared to average annual economic benefits that would be produced by the project. To be recommended a project must have a benefit-cost ratio of greater than one-to-one. In addition, alternative plans for different channel depths are compared to determine and recommend the plan which has the highest annual net benefits. Net benefits are total annual benefits minus total annual costs.

**TABLE 1  
BOSTON HARBOR NAVIGATION IMPROVEMENT STUDY  
PROJECT FIRST COSTS (DESIGN AND CONSTRUCTION)**

January 2008 Price Levels Project Segments Color-Keyed to Summary Map	Main Channels Improvements 48-Foot (50 Ft Entrance)	Main Ship Channel Extension to Marine Terminal	Mystic River Channel Deepening	Chelsea River Channel Deepening & Minor Widening	Total All Recommended Improvements
<b>GNF Construction</b>					
Channel Improvements	\$200,853,000	\$11,669,000	\$1,848,000	\$8,297,000	\$222,667,000
Contingencies	34,248,000	2,801,000	203,000	1,162,000	38,414,000
Planning, Engineering and Design	4,654,000	363,000	170,000	392,000	5,579,000
Construction Management	7,988,000	833,000	270,000	955,000	10,046,000
Escalated GNF Costs	23,818,000	1,922,000	185,000	808,000	26,733,000
Total GNF	\$271,561,000	\$17,588,000	\$2,676,000	\$11,614,000	\$303,439,000
<b>Non GNF Items (Escalated)</b>					
Real Estate (RE) Massport	\$114,000	15,000	\$4,000	\$18,000	\$151,000
Aids to Navigation (USCG)	192,000	24,000	0	48,000	264,000
LSF - Berth Deepening	494,000	1,248,000	0	2,055,000	3,797,000
<b>Total Escalated Cost</b>	<b>\$272,391,000</b>	<b>\$18,880,000</b>	<b>\$2,680,000</b>	<b>\$13,740,000</b>	<b>\$307,691,000</b>
<b>Total Escalated GNF + RE</b>	<b>\$271,686,000</b>	<b>\$17,605,000</b>	<b>\$2,680,000</b>	<b>\$11,633,000</b>	<b>\$303,604,000</b>

Note: GNF = General Navigation Features (Federal Project), LSF = Local Service Facilities (Massport Work)

At Boston Harbor, four separate improvements to different portions of the existing navigation features are recommended for improvement. As described above these are: (1) the Main Channels Improvements accessing the Conley Terminal, (2) the Main Ship Channel deepening extension to the Marine Terminal, (3) the Mystic River Channel, and (4) the Chelsea River Channel. Each project segment was examined incrementally foot-by-foot to determine the channel depth yielding the highest net benefit.

The annual costs, annual benefits, and benefit cost analysis for the four project segments are shown in Table 2.

## **COST SHARING**

Cost sharing for navigation improvement project varies with the recommended project depth. Where entrance channels have been increased in depth relative to interior channels to compensate for increased seas and vessel motion, the interior channel depths controls the cost-sharing. Project costs for depths of up to 45 feet MLLW require the non-Federal Sponsor to provide 25% of the design and implementation cost before and during the construction phase, with an additional 10% reimbursement due following construction. Project depths of greater than 45 feet increase the non-Federal up-front share to 50% for the additional cost for the greater depth, plus the 10% reimbursement. Where an improvement includes dredging above and below the 45-foot elevation, the costs must be split and the two share percentages applied to each increment. Also, 50% of the cost of future maintenance attributable to the increment beyond 45 feet must be borne by the non-Federal sponsor, while the maintenance attributed to the increment up to 45 feet is borne by the Federal government.

All costs for local service facilities (LSF) required to achieve project benefits must be borne by non-Federal interests. For this project those LSF facility costs are limited to the cost of deepening terminal berths where necessary. Real Estate costs must also be provided at the expense of non-Federal interests. For this project, as all work is subtidal, there are no real estate costs other than rental costs for temporary lands needed for construction office space during the period of construction. Cost sharing for the four project segments is shown in Table 3.

**Project Implementation:** Massport is the non-Federal Sponsor, and would supply all necessary items of local cooperation, including the non-Federal shares of design and construction costs, berth deepening at its facilities, and temporary space for construction offices, and waterside access for construction plant.

All construction, including disposal, would be subtidal. All construction plant would be waterborne. All dredging would be by a heavy toothed bucket dredge capable of removing the stiff clay, glacial till and blasted rock. Dredging in various areas of the harbor would be sequenced to minimize impacts on fish and shellfish populations that exist in different areas of the harbor at different times of year. Under the Federal base plan approved by US EPA, all disposal of dredged materials would occur in Federal waters at the MBDS. Beneficial uses of rock for various purposes including habitat creation and shore protection, and use of unconsolidated materials for capping of the former Industrial Waste Site in Massachusetts Bay would be examined further during design with the assistance of the TWG.

**TABLE 2**  
**BOSTON HARBOR NAVIGATION IMPROVEMENT STUDY**  
**EQUIVALENT ANNUAL COST, BENEFITS AND BENEFIT-COST ANALYSIS**  
(January 2008 Price Levels, 50-Year Period of Analysis, 4-7/8 Percent Discount Rate, Base Year 2014)

Project Segments Color-Keyed to Summary Map	Main Channels Improvements 48-Foot (50 Ft Entrance)	Main Ship Channel Extension to Marine Terminal	Mystic River Channel Deepening	Chelsea River Channel Deepening & Minor Widening	Total All Recommended Improvements
<b>Investment Costs (No Escalation)</b>					
Total First Costs (GNF/ATON/RE)	\$248,049,000	\$15,705,000	\$2,495,000	\$10,872,000	\$277,121,000
Total LSF Cost	450,000	1,112,000	0	1,911,000	\$3,473,000
Interest During Construction	15,877,000	97,000	0	90,000	\$16,064,000
Total Investment Cost	\$264,376,000	\$16,914,000	\$2495,000	\$12,873,000	\$296,658,000
<b>Average Annual Costs</b>					
Interest and Amortization	\$14,202,000	\$909,000	\$134,000	\$692,000	\$15,937,000
Increased Maintenance	218,000	18,000	11,000	165,000	\$412,000
Total Average Annual Costs	\$14,420,000	\$927,000	\$145,000	\$857,000	\$16,349,000
Average Annual Benefits	\$23,635,000	\$1,970,000	\$230,000	\$2,536,000	\$28,372,000
Net Annual Benefits	\$9,215,000	\$1,043,000	\$85,000	\$1,679,000	\$12,023,000
Benefit-Cost Ratio – 4-7/8 %	1.64	2.13	1.59	2.96	1.74
Benefit-Cost Ratio at 7 Percent	1.22	1.58	1.20	2.35	1.30

Note: Costs used for benefit-cost analysis do not include cost escalation.



**TABLE 3**  
**BOSTON HARBOR NAVIGATION IMPROVEMENT STUDY**  
**COST SHARING (\$1000s – Escalated Costs)**

	Total Cost	Federal Up-Front Cost Share (75%)	Massport Up-Front GNF Cost Share (25%)	Massport 10 Percent Reimbursement (Post-Construction)	Non-Federal Funded Items (LSF & RE)	U.S. Coast Guard (ATON)
PED (Design Phase for GNF)	\$5,634	\$4,226	\$1,408	\$563		
Berth Design	\$307				\$307	
Construction - GNF	\$297,805	\$199,920	\$97,885	\$29,781		
Berth Deepening	\$3,490				\$3,490	
Real Estate	\$165			-\$165	\$165	
Aids to Navigation	\$290					\$290
<b>TOTAL</b>	<b>\$307,691</b>	<b>\$204,146</b>	<b>\$99,293</b>	<b>\$30,179</b>	<b>\$3,962</b>	<b>\$290</b>

Note: All costs in this table are based on January 2008 price levels, and include cost escalation to the period of design or construction, as applicable. Massport's initial up-front share of design costs is 25%. The Non-Federal up-front cost share equals 25% of the cost for the General Navigation Features (\$74,452) plus and additional 25% (50% total) of the cost of dredging beyond 45 feet to a 48-foot project (\$23,291), plus the remaining non-Federal design phase cost proportionate to a second 25% (50% total) of the design cost allocated to deepening beyond 45 feet (\$142) for a total of \$97,885. The non-Federal reimbursement includes 10% of the total cost of design and construction of the General Navigation Features (\$563 for design and \$29,781 for construction). Massport's Real Estate costs (\$165) are creditable against its 10% post-construction reimbursement of GNF costs, for a net reimbursement of \$30,179.

**Operation and Maintenance:** Operation and maintenance of the completed project would be limited to periodic maintenance dredging of the channels and other dredged features of the project. The Corps would undertake this maintenance with financial participation from Massport for a portion of the cost of maintaining those channels deepened beyond 45 feet. The Sponsor and other terminals owners would be responsible for the periodic maintenance of their individual berths. Major maintenance dredging is currently required for the various segments of the existing project every 16 to 40 years, and the same is anticipated for the improved project.

## **OTHER CONSIDERATIONS**

**Key Social and Environmental Factors:** Boston is New England's largest city and largest seaport. More than 40 percent of Boston's 2006 loaded TEU volume was exports. Waterborne commerce is an important part of the region's economy and development. The project benefits are primarily derived from reducing the truck hauling miles for containerized cargo with an origin or destination in New England, except the region's southwest which is closer by land to New York. Most New England cargo is landed in New Jersey and trucked through New England. Bringing more cargo to Boston by water would save several million truck-miles annually over New England roads. However, as more cargo would be shipped through the Port of Boston, roads in the immediate vicinity of the Conley Terminal would see an increase in truck traffic. This is offset by the proximity of the terminal to the Interstate 90 ramps at the seaport about one mile west of the terminal, mostly through the industrial seaport area. Overall, there is a significant savings in cost, time, fuel and air emissions from shipping New England cargo through Boston rather than the Port of New York-New Jersey.

In addition to being the region's largest commercial port, Boston Harbor is also a natural resource. The Boston Harbor Island National Recreation Area and Boston Harbor Islands State Park draw millions of visitors annually. Commercial lobstermen set their traps in the harbor, and a commercial fishing fleet operates out of South Boston. As the proposed improvements are largely confined to existing channel areas, the impact of port deepening is confined to areas already impacted by periodic maintenance dredging. However, close coordination of construction activities with other harbor interests will be necessary to minimize conflicts and impacts on those uses. Some impacts, though negligible against the background of a major urban industrial port, are unavoidable, including the noise and light of the several vessels comprising the floating construction plan, and submarine blasting operations.

**Stakeholder Perspectives and Differences:** The Boston Harbor Deep Draft Navigation Feasibility Study was conducted and the report prepared in partnership with Massport, the non-Federal Sponsor for the study. An interagency Technical Working Group (State, Federal, Municipal, Universities, and local NGOs) was engaged throughout the study. A total of 17 comment letters were received on the Draft documents; four from Federal agencies, seven from State agencies, the City of Boston, Town of Winthrop, and four local non-governmental organizations with interest in the harbor. There are several areas that will require continued coordination during the Design Phase.

- The project will require blasting of about one million cubic yards of rock. Agencies expressed concern with the impacts of blasting on fisheries, shellfish, whales and the whale listening system of buoys in the bay monitored to reduce ship strikes. The TWG members agreed to form a sub-group during the Design Phase to develop a blasting plan that would incorporate management practices and adaptive management processes to minimize the impacts of blasting on these resources.
- The beneficial use proposal for the blasted rock to create hard bottom habitat in the Bay will require additional investigation, coordination, and design. Several agencies expressed doubts on the acceptability or technical success of rock reef creation and the need to investigate siting, target species benefits, monitoring and measures of success. The TWG members will assist in the investigation and development of this potential opportunity.
- The State and some agencies requested more consideration of alternative beneficial uses for the blasted rock, including use in shore protection projects or other construction purposes. MA CZM has initiated discussions with some parties interested in receiving the rock from the project. The Corps, Massport and the State will investigate the potential for these opportunities further in the Design Phase.
- The beneficial use proposal to use the unconsolidated dredged material to cap the IWS will require further investigation, coordination, and design by the Corps, EPA and others. Some parties may object to any activity that would disturb this site, though all comment received on the Draft report was supportive of this plan. A field demonstration at the MBDS using clay dredged to form the inner harbor CAD cells for the current maintenance dredging project is ongoing. Should it be determined that the site may not be capped with this material without additional significant impacts that outweigh any potential benefit from capping, then this dredged material would be placed at the MBDS as included in the current base plan. Should the capping prove feasible through the demonstration, then the Corps and EPA would scope any additional work during the Design Phase. EPA would also need to prepare NEPA documentation to modify the existing MBDS boundaries to allow the capping of the IWS with dredged material.
- Lobstering occurs in many areas of the harbor, including some lobstermen who place their traps and gear in the navigation channels. This un-permitted activity, while a hazard to navigation nevertheless occurs, and lobstermen must be informed and updated on dredging schedules for various project areas as work progresses, so that gear can be removed prior to dredging, drill and blasting.
- Maintenance dredging of several areas of the project may occur concurrent with the improvement work. This includes maintenance of inner harbor areas requiring disposal in some of the harbor's confined disposal cells, or other materials permitted for disposal offshore. This work will need to be planned and budgeted (by the government and Sponsor) concurrent with the improvement work that in some areas will be removing material lying beneath the maintenance material.
- Resource characterization of the dredge areas would be reanalyzed during the design phase, as major maintenance of the harbor channels was ongoing through the feasibility study and currently. Agency comments pointed to a need for updated post-maintenance characterization to serve as a basis for determining what resources are present in which areas of the harbor at what times of year, in order to develop construction sequencing.

- Agency comments also focused on development of construction sequencing plans to avoid and minimize impacts to harbor resources. These plans require the completion of Design Phase field investigations to permit mapping of harbor bottom types with and without the project, develop resource mapping and timelines, construction durations for blasting and dredging in various project reaches, and merge all the data together to find the best fit of construction sequencing with resource concerns.
- Air Quality compliance is currently achieved by avoiding emissions thresholds through construction shutdowns that limit work to nine months per year. Emissions credits and offsets were investigated but could not be identified at the feasibility phase. These will be re-examined during the design phase, and if identified, should reduce compliance costs.

## **REVIEW OF THE DRAFT FEASIBILITY REPORT AND SEIS**

The Draft Feasibility Report and SEIS/EIR were released for public and agency review on 11 April 2008, with Notice of Availability published in the Federal Register on 18 April 2008. The public review period under the NEPA and State processes closed on 2 June 2008. A public meeting was held in South Boston on 20 May 2008. Comments and concerns raised by the reviewers have been addressed and incorporated into the Final Feasibility Report and SEIS/EIR.

At the conclusion of Design Phase investigations and detailed implementation plans, the Federal and State regulatory processes would be completed and the final regulatory approvals obtained for the project. Any significant new information developed in the Design Phase, and changes to the project recommendation, and any construction sequencing or changes in air quality compliance, would be published in additional NEPA/MEPA documents to solicit public participation.